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Biodegradation of high concentrations of benzene vapors in a two phase partition stirred tank bioreactor

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Abstract

The present study examined the biodegradation rate of benzene vapors in a two phase stirred tank bioreactor by a bacterial consortium obtained from wastewater of an oil industry refinery house. Initially, the ability of the microbial consortium for degrading benzene was evaluated before running the bioreactor. The gaseous samples from inlet and outlet of bioreactor were directly injected into a gas chromatograph to determine benzene concentrations. Carbone oxide concentration at the inlet and outlet of bioreactor were also measured with a CO2 meter to determine the mineralization rate of benzene. Influence of the second non-aqueous phase (silicon oil) has been emphasized, so at the first stage the removal efficiency (RE) and elimination capacity (EC) of benzene vapors were evaluated without any organic phase and in the second stage, 10% of silicon oil was added to bioreactor media as an organic phase. Addition of silicon oil increased the biodegradation performance up to an inlet loading of 5580 mg/m^3, a condition at which, the elimination capacity and removal efficiency were 181 g/m^3/h and 95% respectively. The elimination rate of benzene increased by 38% in the presence of 10% of silicone oil. The finding of this study demonstrated that two phase partition bioreactors (TPPBs) are potentially effective tools for the treatment of gas streams contaminated with high concentrations of poorly water soluble organic contaminant, such as benzene.

Keywords: Two phase partition bioreactors, (TPPBs), Benzene, Silicon oil, Biotreatment